Audio Notes

AUDIO PRODUCTS DEPARTMENT — DECATUR, ILL.

VOLUME 3 NO. 4 AUGUST, 1964

BASS BOOST - T7, T15, T25, T50C, AND T113

A quality feature, "Bass Boost", has been incorporated in the transistorized amplifiers used in the 1965 General Electric Console Phonograph line.

The function of the Bass Boost circuit is described in the User Manual and states: "The Bass Boost Switch compensates for the human ear's inability to hear Bass sounds at a low listening level. Should more Bass be desired at a low volume setting, push this switch to "ON". The switch has no effect at high volume levels."

An explanation of how the circuit operates is as follows:

The Bass Boost circuit consists of three parts, a resistor, a capacitor, and a two position ON-OFF slide action switch.

The capacitor and resistor are connected in series from the 2nd. tap of the Loudness Control (1st. tap from ground). The capacitor is connected across the slide switch.

When the switch is closed (Bass Boost OFF) the capacitor is shunted by the switch and the only resistor is connected in parallel with the lower portion of the Loudness Control. The resistor is not frequency sensitive, therefore, the input signal, consisting of many frequencies, sees the same impedance. The ratio of Bass to higher frequencies presented to the Preamplifier is unchanged.

When the switch is opened (Bass Boost ON) the capacitor is now in series with the resistor. The reactance (effective resistance) of the capacitor increases inversely with frequency. At the lower or Bass frequencies the shunting effect of this network will be much less. It will allow more of the Bass frequency input to be developed across this portion of the Loudness Control and will in turn present to the Preamplifier Transistor a greater ratio of Bass to higher frequencies.

Audio Notes
AUDIO PRODUCTS DEPARTMENT — DECATUR, ILL.

VOLUME 3 NO.4 SEPT. 1964

FM ANTENNA CONSIDERATIONS

FM and FM Stereo is on a very positive upswing. It is important that the Audio technician be aware of the complexities of the FM antenna system when recommending the proper antenna system for each individual customer. This article will explain some of the factors which determine the effectiveness of the FM antenna system.

Under normal conditions, satisfactory FM reception of local stations (within 25 miles) should be obtained on the built-in antenna. House construction containing an excessive amount of metal (wiring, plumbing, aluminum siding) or locations in low elevation or distant areas, may require external antenna. Generally if TV reception is good, FM reception should be good, since the FM band falls between TV channels 6 and 7.

Weak FM reception may be detected by a continuous hissing noise, like rushing air, while listening to a FM station. This condition is more pronounced on FM stereo reception since the transmitted side bands of the FM stereo signal have a shorter range than the regular FM signal.

Built-In Antennas

Any built-in antenna produces sensitivity and directivity by its close proximity to other parts of the set. The impedance of an antenna depends on its type and mounting. A monopole antenna is a ground plane antenna. With a poor ground plane, its impedance is higher than nominal and reactive.

Our tuners have an input impedance designed for 300 ohms unbalanced. Typical built-in antenna impedances are summarized in the following chart:

1. Folded Dipole	300 ohms balanced
2. Folded Monopole	150 + ohms unbalanced
3. Rabbit Ears	70 ohms balanced
(W/balun)	300 ohms
4. Monopole	35 + ohms balanced
(W/balun)	150 + ohms

A PRODUCT SERVICE PUBLICATION

NOTE: A balun is a 4 to 1 impedance transformer that is usually used to balance 75 ohms unbalanced antennas to 300 ohms balanced or unbalanced tuners. Mis-matching impedances result in reduced sensitivity and poor SWR (standing wave ratio).

In order to improve local reception an antenna should be placed on the roof above wiring and surrounding objects. Run the 300 ohm lead-in wires away from metal objects and house wiring. Twist the lead-in (about 1/2 turn every foot) to reduce stray pick up.

When choosing the antenna type, consider that outdoor antennas fall into two general categories. (1) non-directional "low gain" antennas usually used for local reception and (2) directional "high gain" antennas usually used for long distance reception. See the following chart for the various antenna types and characteristics for the different antenna types.

ANTENNA TYPE	POWER GAIN	DIRECTIVITY PATTERN	EFFECTIVE DISTANCE (MILES)
(1) Folded Dipole	1	Null at sides Figure 8	30/45
(2) Turnstiles Quadrature Fed.	1	Almost circular	30/45
(3) "S" Folded Dipole	.8	Null at sides Fat Fig. 8	25/40
(4) F. Dipole W/reflector	2	Null at sides F/B Ratio=4	40/60
(5) 4 Element Yagi	4	Null at sides F/B ratio=8	50/80
(6) 6 Element Yagi	7	One direction only F/B ratio=100	55/120
(7) 10 Element Yagi	10	One direction only F/B ratio=100	60/150

NOTE: "Power Gain" indicates the increase in power over a dipole antenna in the direction of best reception. F/B ratio means the ratio of power received from the front of the antenna to that received from the back. The first number given under distance indicates reliable reception over level ground. The second figure indicates reception during temperature inversion or when the transmitter is greatly elevated such as located on a mountain.

Long distance FM reception suffers the same limitations as long distance TV reception.

Line of Sight Limitations

Very high frequency VHF signals travel almost in straight lines like light beams. They can be blocked by any object between the transmitting and receiving antennas (such as mountains, hills, buildings, steel tower, or the curvature of the earth).

Weather

Normally the surface air is warmer than the upper atmosphere. This tends to bend radio waves away from the earth. Occasionally warm air will override a cool surface air layer, this is called "temperature inversion" and causes radio waves to follow the surface of the earth, thus on a hot summer day reception is poor and on an unusually cool evening long distance reception is good.

Antenna Boosters

If all stations are over 10 miles away an antenna booster will usually improve reception. When there is a strong local station, however, it may overdrive the booster, causing distortion and multiple reception across the F.M. band.

If a strong local station is causing overload and multiple reception across the dial a tuneable FM antenna trap is recommended. Insert the trap in the lead-in wire between the antenna and the FM tuner and tune the trap to reduce the signal of the offending station. If an antenna booster is used, the trap should be inserted between the antenna and booster.

Audio Notes

AUDIO PRODUCTS DEPARTMENT — DECATUR, ILL.

VOLUME 3 NO.6 OCT. 1964

This month's Audio Notes consists of service hints that have been compiled from information supplied to us by field personnel and from factory experience.

SERVICE HINTS

CHASSIS	SYMPTOM	CAUSE - CURE
T50-T113	Distortion at low levels on left channel, may be misinterpreted as cross-over distortion. Can appear intermittent.	Capacitor C35 (.068 mfd 60 ceramic) is dressed incorrectly causing the leads to touch the metal chassis. Dress cap away from chassis.
T50-T113	Cannot adjust idling current (I_C of TR9) below 25 to 50 ma.	Tuner power is taken from the collector (heat sink) of TR9 and is approximately 50 ma. Disconnect the tuner power input clip lead then adjust R49 to measure 1.5 to 2 ma idling current for TR9.
T50-T113	Distortion at low levels on one or both channels.	Idling current of TR9 and or TR10 not adjusted to the proper 1.5 to 2 ma specification. Probably is set lower than 1 ma.
T113	Static type noise on one or both channels not effected by rotation of controls. Can be intermittent or occur after the unit has operated 1 to 2 hours.	Defective or noisy bias stabilizing diode D5 and or D6. To diagnose and isolate the problem, the diode may be temporarily disconnected from the circuit. REMEDY - replace diode.
T25	High frequency oscillation at about 10KC or higher when using modified headphones. May be audible or may hear a slight click. Usually happens at low or high end of treble control rotation.	Headphones may reflect a high impedance load to output transistors, C29, and/or C30 maybe at lower tolerance limit or beta of TR9 and/or TR10 higher than normal. REMEDY - Install 100 ohm resistor across headphone jack for each channel, and change C29 and C30 to .1 mfd @ 200V.

CHASSIS	SYMPTOM	CAUSE - CURE
G.E. Changer	Turntable rotates slow, stalls during cycle, or does not rotate. Motor is operating.	Oil may have migrated from the turntable hub to the turntable drive rim and idler wheel. Clean all drive surfaces with alcohol and apply non-slip compound GC No. 1210 to all drive surfaces. If oil is heavy the idler wheel should be replaced.
TU405 TU410	Weak, distorted FM. Can be intermittent.	Discap C34 (mounted inside FM discriminator can) .01 mfd, may be shorting to the side of the can. Dress capacitor away from metal.
TU405 TU410	No FM, tuning meter pins.	Discap C34 leaky or shorted. Replace capacitor.
TU376 TU405 TU410	Very low FM sensitivity.	Capacitor C11 (.01 mfd 50V discap) shorted, causing very low or no collector voltage to TR2. Replace capacitor.
TU300 TU376 TU405 TU410	Low to very low AM and FM sensitivity.	Capacitor C49 (10 mfd 15V electrolytic) leaky or short will reduce forward bias to TR4. Replace capacitor.
T50-T113	To make the amplifier more thermally stable. Following each repair make sure that the split-tube slip-on heat sinks, Cat. No. EA41X5,are installed on driver transistors TR3, 4, 5, and 6. The heat sink must make a solid physical connection to the transistor body. Some early amplifiers did not have these heat sinks installed. It is suggested that these be installed when missing.	

OOPS.............CORRECTION

September Audio Notes was numbered Vol. 3 No. 4 --- should be Volume 3 No. 5.

Audio Notes
AUDIO PRODUCTS DEPARTMENT — DECATUR, ILL.

VOLUME 3 NO. 7 NOV. 1964

PRECAUTIONS - TRANSISTOR TESTING WITH OHMMETER

An ohmmeter can be an invaluable aid in the servicing of transistorized equipment but it can also be a source of concern. The ohmmeter can be used to locate opens and shorts in transistors, and with a little experience and/or the use of comparative readings, can be used to check for abnormal leakage.

If the meter probe polarity is known, the transistor type (NPN or PNP) can be determined quite rapidly with the ohmmeter. Since base to emitter and base to collector forward bias resistances are low comparatively, the type of base material (N type or P type) can be readily identified by making forward and reverse bias readings between each pair of elements and assigning probe polarity to the element (base) that produces low value readings to the other two.

The technician should be certain, before attempting to test a transistor with an ohmmeter, that the voltage across the meter test probes does not exceed the maximum voltage ratings of the transistor and that the series resistance of the meter is sufficient to limit the current thru the junction under test to a safe value. When maximum voltage ratings of the transistor are not available, the technician can refer to the schematic diagram of the equipment being serviced to obtain D.C. operating voltages which should be below the manufacturer's maximum ratings.

Since the voltage and current ratings of many transistors used in home entertainment equipment are quite small, it is considered good practice, when testing these units, to use a 20,000 ohm/volt meter supplying not more than 1.5 volts across its test probes and the use of the RX100 scale to insure sufficient series resistance to limit junction current to values well below the maximum ratings of the unit being tested.

In no case should a meter containing a battery with a voltage rating exceeding 15 volts be used without the addition of a series resistor to protect the transistor.

To summarize: Much benefit in the servicing of transistorized equipment can be derived from an ohmmeter if its characteristics are known and if necessary precautions are taken to limit to safe values the power supplied by the meter to the transistor junctions.

This article does not constitute a recommendation for the use of an ohmmeter in lieu of a quality transistor checker, but is intended to prevent transistor damage when using the ohmmeter as a go-no-go transistor tester.

GERMANIUM "TOP HAT" TRANSISTOR CODING

The black "top hat" germanium type transistors used in Audio Products Department tuners and amplifiers have two numbers imprinted on the transistor side wall. One is the Engineering drawing number (example below) and the other number is the vendor date code. Some transistors have a vendor date code number that is the same as an electronic parts jobbers' catalog number for a G. E. universal replacement rectifier. This number is GE504 and it is recommended as a replacement for selenium and silicon rectifiers used in TV receivers.

DO NOT confuse this date code number, GE504, as a part number for a black "top hat" type germanium transistor. Always refer to the replacement parts list for the correct part number.

Defined below is the meaning of the imprinted numbers on the transistor side wall.

DEFINITION OF IMPRINTED NUMBERS

173A4348 - Engineering drawing number.

GE504 - Vendor date code on transistor.

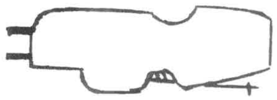
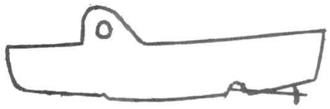
This is not a catalog number.

Audio Notes
AUDIO PRODUCTS DEPARTMENT — DECATUR, ILL.

VOLUME 3 NO.8 DEC. 1964

CARTRIDGES AND IMPEDANCE MATCHING PREAMP USED IN THE 1965 GENERAL ELECTRIC CONSOLE PHONOGRAPH LINE

There are two different types of ceramic cartridges used in the 1965 General Electric Console Phonograph line. The table below lists the cartridges under the heading which describes the specifications for each group of ceramic cartridges:

	GROUP 1		GROUP 2	
SPECS	Output - 60 mv RMS Capacity - 16,000p per channel		Output - 300 mv RMS Capacity - 1,000p per channel	
Shell Design #1 	C400	EA80X152	C100A	EA97X569
			C40	EA80X208
			C450	EA80X208
	Stylus	EA97X561	Stylus	EA97X561
Shell Design #2 	C500	EA80X165	C50	EA80X209
			C600	EA80X209
	Stylus	EA80X166	Stylus	EA80X166

NOTE: Shell design #1 is used in both group 1 and group 2. Stylus EA97X561 is used with shell design #1 in both group 1 and group 2.

Shell design #2 is used in both group 1 and group 2. Stylus EA80X166 is used with shell design #2 in both group 1 and group 2.

The identifying number such as C40 will be found on the top side of the cartridges with shell design #1 in both group 1 and group 2.

The identifying number such as C50 will be found on the bottom side of the cartridges with shell design #2 in both group 1 and group 2.

Note that the C40 and C450 have a common replacement part number EA80X208. The C40 was an interim production number and was superseded by the C450 hence only one replacement part number for the C40 and C450.

The C50 and C600 have a common replacement parts number EA80X209. This is because the C50 was also an interim production number and was superseded by the C600.

The cartridges listed under group 1 will match the low input impedance of the transistorized amplifiers for the 1965 Console Phonograph line. (T7, T15, T25, T50, and T113.)

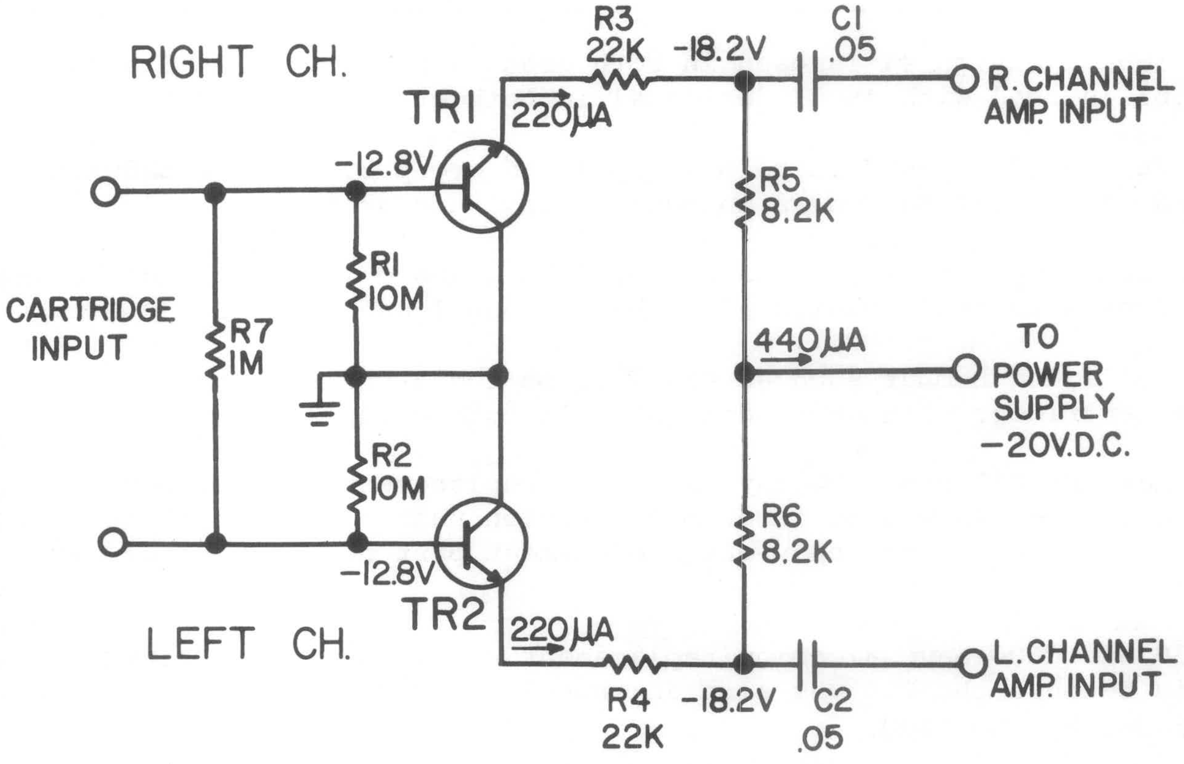
The cartridges listed under group 2 are also used with the transistorized amplifiers of the 1965 Console Phonograph line. However, since the cartridges listed under group 2 have a higher voltage output and lower capacity it is necessary to employ a transistorized impedance matching preamplifier between the cartridge and transistorized main audio amplifier. This impedance matching preamplifier is mounted on the under side of the record changer base plate and receives -dc power from the transistorized main audio amplifier.

Console phonographs which incorporate the cartridges under group 2 and employ the transistorized impedance matching preamplifier are designated by the suffix letters "AB" after the model number.

FOR EXAMPLE - RC7430AB

IMPORTANT: Do not substitute the cartridges listed under group 1 with those cartridges listed under group 2 or visa versa. A serious mismatch between cartridge and amplifier would be present which would result in a large input signal loss, greatly reducing the total acoustical output of the console phonograph.

A schematic diagram of the transistorized impedance matching preamplifier is shown below:



PREAMPLIFIER SCHEMATIC

Audio Notes
AUDIO PRODUCTS DEPARTMENT — DECATUR, ILL.

VOLUME 4 NO. JAN. 1965

Electronic Pack Concept

The Electronic Pack concept, designed by General Electric Audio Products Department, unitizes the entire electronics of the console system. The amplifier-tuner assembly can be removed from the cabinet as a unit for servicing. The removal instructions are outlined in the Service Manual for each specific model. Two configurations of Electronic Packs are used:

1. Stacked Pack
2. End to End Pack

Listed below are the current 1964-65 Console Model Series with amplifiers and tuners identified.

STACKED ELECTRONIC PACK

MODEL SERIES	AMPLIFIERS	TUNERS
RC7430-RC7490-RC8170	T7	TU376-1
RC7530-RC7440-RC7890	T15	TU376-1
RC8370-RC8570	T15	TU376-1
RC7630	T25	TU376-1
RC7690	T30	TU376-1
RC7830	T113	TU405-1
MC9430	T15	TU222-10 (Tube Type)
MC9630	T25	TU222-10 (Tube Type)
CC9730	T15	TU376-2
CC9930	T113	TU405-3

END TO END ELECTRONIC PACK

RC6730	T15	TU376-3
RC7730-RC7740	T50C	TU410-1

To improve serviceability, all leads and cables to the Electronic Pack are connected by plug-socket and/or fast-on connector methods.

A wiring harness assembly is used on all amplifiers from T15 up to and including the T113. The wiring harness terminates to the amplifier by a 12 terminal Amplok plug. The wiring harness provides the following functions:

1. AC input cord and plug to system
2. AC power cord and plug to record changer
3. AC power cord and plug to Porta Fi
4. AC power cord and plug to Tape Deck (Tape Models)
5. Amplifier output leads to speaker system
    a. Left Speaker System - White Lead
    b. Right Speaker System - Brown Lead
    c. Common (both channels) - Black Lead

Wiring harness as service tool

When servicing the pack in the home or shop, a wiring harness assembly, Cat. No. EA65X3, is a useful tool to operate the pack after removal from the cabinet. The amplifier and/or tuner can be powered for tests and analysis by connecting the wiring harness Amplok plug to the amplifier and connecting the power cord plug to an AC outlet. See your distributor service department for availability of an EA65X3 wiring harness.

Reminders when servicing the electronic pack

1. The amplifier can be operated for voltage and current measurements without a speaker load only if there is no signal input or hum present in the output.
2. Observe the correct loudspeaker load impedance when testing with signal for sensitivity and distortion. Resistor loads of correct value may be used in place of loudspeakers.
3. Output impedances specified for each amplifier channel are as follows:

T7 Amplifier	16 ohms
T15 Amplifier	8 ohms
T25 Amplifier	8 ohms
T50/113 Amplifier	3.2 ohms

4. Never allow the loudspeaker leads to become shorted.
5. A pair of stereo headphones can be used for listening tests by plugging into the headphone jack which is located on the escutcheon. Remember that the headphone impedance of the GE recommended Sharpe HA8 is approximately 110 ohms due to a fixed resistor in series with each phone for a better signal to noise ratio. Therefore, hum and buzz will be very prominent on unmodified phones. Always double check your listening tests by using the correct speaker system.
6. The tuner output is a good source of audio to perform listening tests on the amplifier since it is self contained on the pack and is powered.

Audio Notes
AUDIO PRODUCTS DEPARTMENT — DECATUR, ILL.
VOLUME 4 NO. 2 FEB. 1965

USE OF STEREO HEADPHONES WITH GENERAL ELECTRIC CONSOLE PHONOGRAPHS

A Stereo headphone is a very sensitive instrument. Most stereo headphones require only about 10 millawatts of power to reproduce a comfortable listening level.

The very best amplifiers have a certain amount of hum and noise which may be audible when driving the very sensitive stereo headphones.

The stereo headphones recommended for use with General Electric consoles are models HA-8 and HA-10 manufactured by the E. J. Sharpe Instrument Co. These are available from General Electric Distributors and Dealers.

The HA-8 and HA-10 Stereo headphones have a 100 ohm resistor installed in series with each stereo headphone unit to attenuate the signal, hum and noise level.

Stereo headphones, other than the recommended HA-8 or HA-10 type, can be modified for use with General Electric Console Phonographs by installing a 100 ohm resistor in series with each stereo headphone unit to reduce the hum and noise level. The value of this series resistor is not critical. A resistor value of 220 ohms may be necessary with some stereo headphones and amplifiers in order to reduce the hum and noise to an acceptable level.

A quick check may be made on any stereo headphone unit with an ohmmeter to determine the presence of the series resistor. If the impedance of the stereo headphone unit is supposed to be 8 ohms, an ohmmeter check made at the stereo headphone plug should indicate a total impedance of approximately 100 ohms if the resistor is installed.

Audio Notes
AUDIO PRODUCTS DEPARTMENT — DECATUR, ILL.
VOLUME 4 NO. 3 MARCH 1965

NOISE ON A. M. FUNCTION - 1965 CONSOLE PHONOGRAPHS

A static-like noise on AM function only, resembling that caused by a loose or intermittent electrical connection may be evidenced on certain 1965 Model Console Phonographs equipped with transistorized tuners.

This condition was experienced in the factory prior to the beginning of 1965 model production and was traced to the pilot lamps. The lamps being used at that time were #53 lamps and the cause of the interference was found to be due to the shorting of filament coil turns when the lamp was jarred or vibrated.

As a result of this, a new lamp #53, was specified for production.

The filament coil of the #53X pilot lamp is supported in two places by a special supporting element. This practically eliminates the possibility of coil turn shorting.

For the most part, the #53X lamp has proved to be very satisfactory in this respect. A few instances have been reported from the field where much time has been spent tracking down this trouble.

We suggest, in the event of AM interference of this type, that the pilot lamps be disconnected at the filament supply to see if the interference disappears. Should the interference cease when the lamps are disconnected, reconnect the filament supply and check the lamps one at a time by tapping lightly while operating the set on a clear AM station.

Replace the offending lamp or lamps with a new EA6X27 pilot lamp. Be certain to also check the replacement lamp.

All EA6X27 lamps in New Concord replacement stock are #53X lamps.

Audio Notes
AUDIO PRODUCTS DEPARTMENT — DECATUR, ILL.

VOLUME 4 NO.4 APRIL 1965

CROSSOVER DISTORTION ON T7 AND T15 AMPLIFIERS

Some T7 and T15 amplifiers may exhibit a distortion at low level listening which is defined as crossover distortion. This generally occurs on cold amplifiers and/or when operated in low ambient temperatures. The problem is basically the same as you have experienced with T50 and T113 amplifiers, that is, low idling current at the output transistors. The exception is the presence of bias adjustment controls on the large amplifiers to accurately set idling current.

The following circuit changes for T7 and T15 amplifiers will establish adequate biasing to the Class B driver stages and, also, provide additional thermal stability due to diode action.

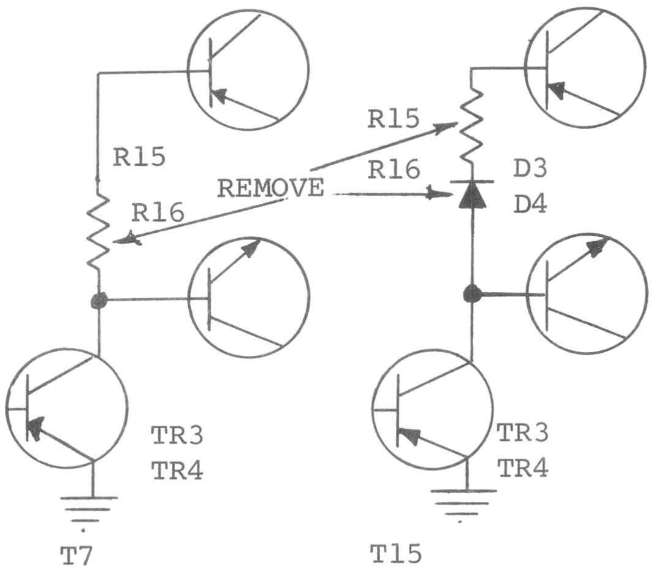
CHANGES TO THE T7 AMPLIFIER

Remove from the circuit board and discard resistors R15 and R16 (these may be 180 or 220 ohms 1/2 watt carbon). Replace, in each channel,with two diodes connected in series. Use the same replacement parts and procedure listed below for the T15 amplifier.

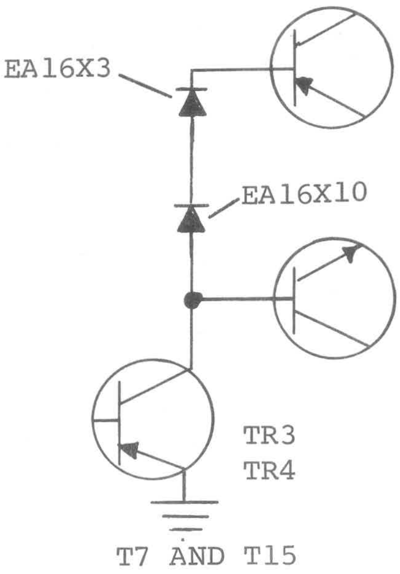
CHANGES TO THE T15 AMPLIFIER

Remove from the circuit board and discard resistors R15, R16 and diodes D3, D4. Replace these components in each channel with two diodes connected in series. Use one catalog number EA16X3 glass type silicon diode and one catalog number EA16X10 germanium power diode, top hat type, connected in series in each channel. The diodes are connected in the circuit to be forward biased. The anodes, therefore, face the collector of TR3 (or TR4 in the other channel). Refer to the illustration shown on the back side.

After the modification is performed a test should be made to determine if the bias voltage drive to the Class B driver stages is correct for each channel. This test will help determine if the Class A driver stages are operating correctly and will test the diodes which have been installed. Apply power to the amplifier, with no signal and with all controls set to minimum. The collector current of TR3 and TR4 should be 4 ma. ± 10% and should produce a voltage drop of .8 volts ± 10% measured across the two series diodes. If the voltage drop across the diodes is not to this specification one of the diodes is defective and should be replaced.



BEFORE



AFTER

Audio Notes
AUDIO PRODUCTS DEPARTMENT — DECATUR, ILL.

VOLUME 4 NO.4 MAY 1965

DISTORTION DUE TO LOW STYLUS COMPLIANCE

Distortion can be caused by a stylus improperly tracking the record groove due to low compliance. This type of distortion obviously appears only when playing a set in the phono position. We have had a few reports that some console models that use an RD125 record changer with a C500 type cartridge have been subject to this type distortion.

Low compliance is caused by a stylus driver tube that is too rigidly mounted in the rubber block of a plastic stylus handle. To correct the distortion, replace the stylus assembly, catalog number EA80X166.

Most generally, piano music or selections where the upper midrange and high audio frequencies dominate, would emphasize the distortion. Symptoms and similarities to other known causes of distortion may lead you to an improper diagnosis.

The distortion appears as harsh, raspy sound which can sound very much like crossover distortion. Except crossover distortion is limited to low level listening and will generally disappear when the unit is warmed up. Each of these distortions can possibly be incorrectly diagnosed as a defective loudspeaker. To help diagnose this problem properly you should make listening tests on tuner function, before condemning the stylus, however if the distortion is due to low stylus compliance, replace stylus assembly, catalog number EA80X166.

Audio Notes
AUDIO PRODUCTS DEPARTMENT — DECATUR, ILL.

VOLUME 4 NO.6 JUNE 1965

THE TAPE RECORDER BIAS OSCILLATOR

The purpose of this article is to clear up some of the mystery surrounding the need for and the use of the Bias Oscillator in tape recorders.

Basic need for a recording Bias in accentuated by the fact that every magnetic medium is essentially a very non-linear medium. This fact is demonstrated in figure 1.

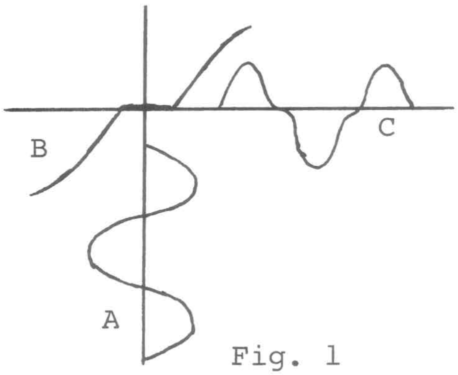


Fig. 1

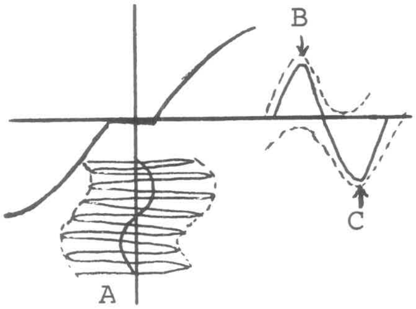


Fig. 2

The "B" curve in figure 1 represents the fact that the magnetization resulting from a given magnetizing field is not directly proportioned to the original signal. If a sine wave such as curve "A" in figure 1 is used as an original signal, the resulting signal with out proper Bias would look like curve "C". With out some form of correction, the recorded material would be very badly distorted. This is where the Bias signal takes over. This is a high frequency current (above the audio range, 30 to 95 kc) added to the audio current to be recorded. The recorded audio magnetization will then be nearly linear to the audio signal applied as demonstrated by figure 2.

The Bias current is generally many times the strength of the recording current as illustrated by curve "A" in figure 2. The dotted envelope represents the strength of the Bias current while the smaller solid curve represents the audio signal. The dotted lines "B" and "C" in figure 2 represent the positive and negative projections of the combined Bias and audio signal. The resultant signal that will be reproduced is illustrated by the solid line "D" in figure 2. The distortion is thereby decreased to a very acceptable level.

The frequency of the Bias current is not critical as far as distortion is concerned. The Bias current frequency should be at least five times the frequency of the highest audio signal to be reproduced to minimize unwanted notes arising from beats between the Bias frequency and harmonics of the audio frequencies. The Bias frequency of the TD100 and TD150 is 85 to 95 kc. The amount of Bias current is chosen by tests of distortion at various frequencies and recording levels. Bias currents of .7MA to 1MA are very common.

It is imperative that the Bias Oscillator output be a clean symmetrical sine wave to further assure distortion free recordings.

In most tape recorders the Bias Oscillator performs a dual function in that it also supplies current to the erase heads. A good clean symmetrical sine wave output from the Bias Oscillator is essential for tape demagnetization. If the waveform of the Bias Oscillator is not symmetrical the resulting magnetic flux would cause increased noise level on the tape due to residual magnetization. In order to get complete erasure, erase current must run higher than Bias current. For instance erase current of the TD100 should be from 25MA to 40MA, while Bias current may be only .7MA. Therefore, it is desirable from a design standpoint to use a relatively low Bias frequency in order to have sufficient power to operate the erase. However, sound wise it is best to have as high an audio frequency as practical.

Audio Notes
AUDIO PRODUCTS DEPARTMENT – DECATUR, ILL.

VOLUME 4, No. 7 JULY 1965

MINUTES WELL SPENT SAVE HOURS. . . . .

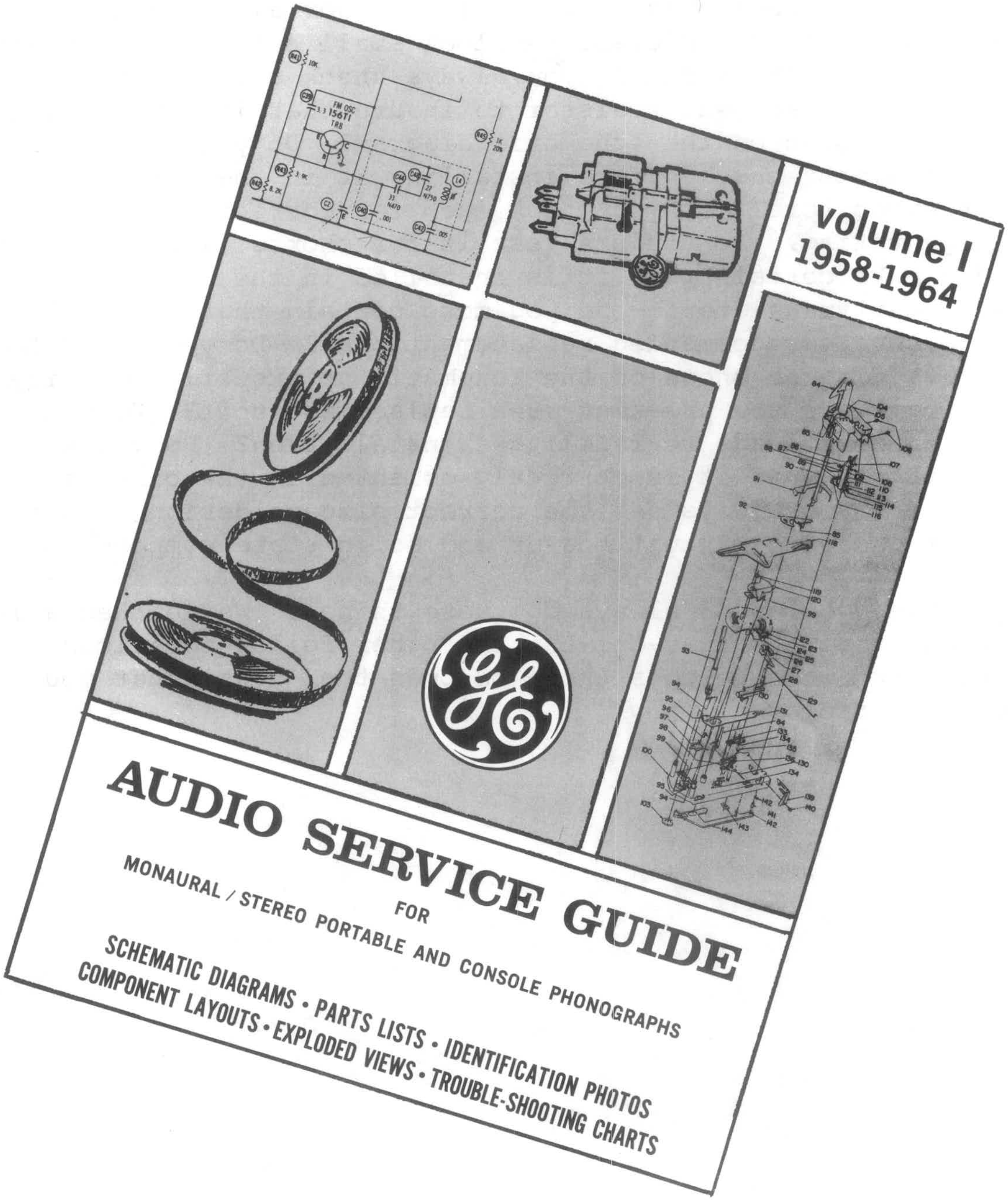
Many times in their haste to complete a normally simple repair job some technicians overlook small but very important details. For instance; Do you always check closely the color code of a replacement resistor to insure that it agrees with the value given on the schematic diagram? Do you then make a quick ohmmeter check before installing it in the circuit? How about capacitors? Do you check each for correct value and voltage rating? Do you pre-test it for shorts, leakage or opens? Do you make certain that it is installed in the correct polarity? What about transistors - do you make certain that it is the manufacturers recommended replacement part? Do you refer to the base diagram shown on the schematic to properly identify each lead? Do you pre-test each replacement unit? Do you pre-shape the leads to facilitate installation? Do you then make certain that it is correctly oriented in the circuit board? Do you always use the correct size soldering iron to prevent damaging circuit boards and solid state components?

Of course, you and I always do these things. We learned a long time ago that they pay-off-but the other fellow sometimes forgets and when he does these becomes the 'dogs' that you and I inherit.

ITS COMING SOON.......

WATCH FOR IT!!!

AUDIO SERVICE GUIDE



volume I
1958-1964

AUDIO SERVICE GUIDE
FOR
MONAURAL / STEREO PORTABLE AND CONSOLE PHONOGRAPHS

SCHEMATIC DIAGRAMS • PARTS LISTS • IDENTIFICATION PHOTOS
COMPONENT LAYOUTS • EXPLODED VIEWS • TROUBLE-SHOOTING CHARTS

Audio Notes

AUDIO PRODUCTS DEPARTMENT — DECATUR, ILL.

VOLUME 4 NO.8 AUG. 1965

TUNER SERVICE HINTS

I. HUM FROM CONSOLE WHEN TUNER ONLY IS OPERATED.

A symptom of audible hum may occur during tuner operation on some of the 1966 Console Phonographs. The symptom is not evident on either Phono or Tape function.

On tuners equipped with tuning meters, this condition is also indicated by a fluctuating tuning meter pointer. On either type tuner the hum waveform can be detected using a scope at the emitter of the tuner power supply transistor.

The cause of this hum has been traced to excessive collector to emitter leakage in the tuner power supply transistor EA15X15. This leakage provides a path from the amplifier power supply through which ripple can enter the tuner circuits.

The transistors that have been found to cause this condition were obtained from only one source of supply. These units can be identified by the name Bendix followed by G.E. Drawing number 173A3963 stamped on the case.

Should you encounter this problem, replace the power supply transistor with a new EA15X15. Your G. E. Distributor's parts stock contains transistors already checked out for this problem.

II. AM AND FM APPEAR NORMAL BUT NO FM STEREO.

The symptom where AM and FM reception is normal but no FM stereo and the stereo star fails to light up may not be a component fault within the stereo circuits.

The source of this symptom is commonly due to a faulty D5 Zener diode, replacement parts number EA16X6. The effect is caused by the DC tuner supply voltage (from the voltage regulator) being less negative than minus 12 volts ± 5% on AM and FM function. The voltage drops considerable lower when an FM station is tuned in which is broadcasting FM stereo signals.

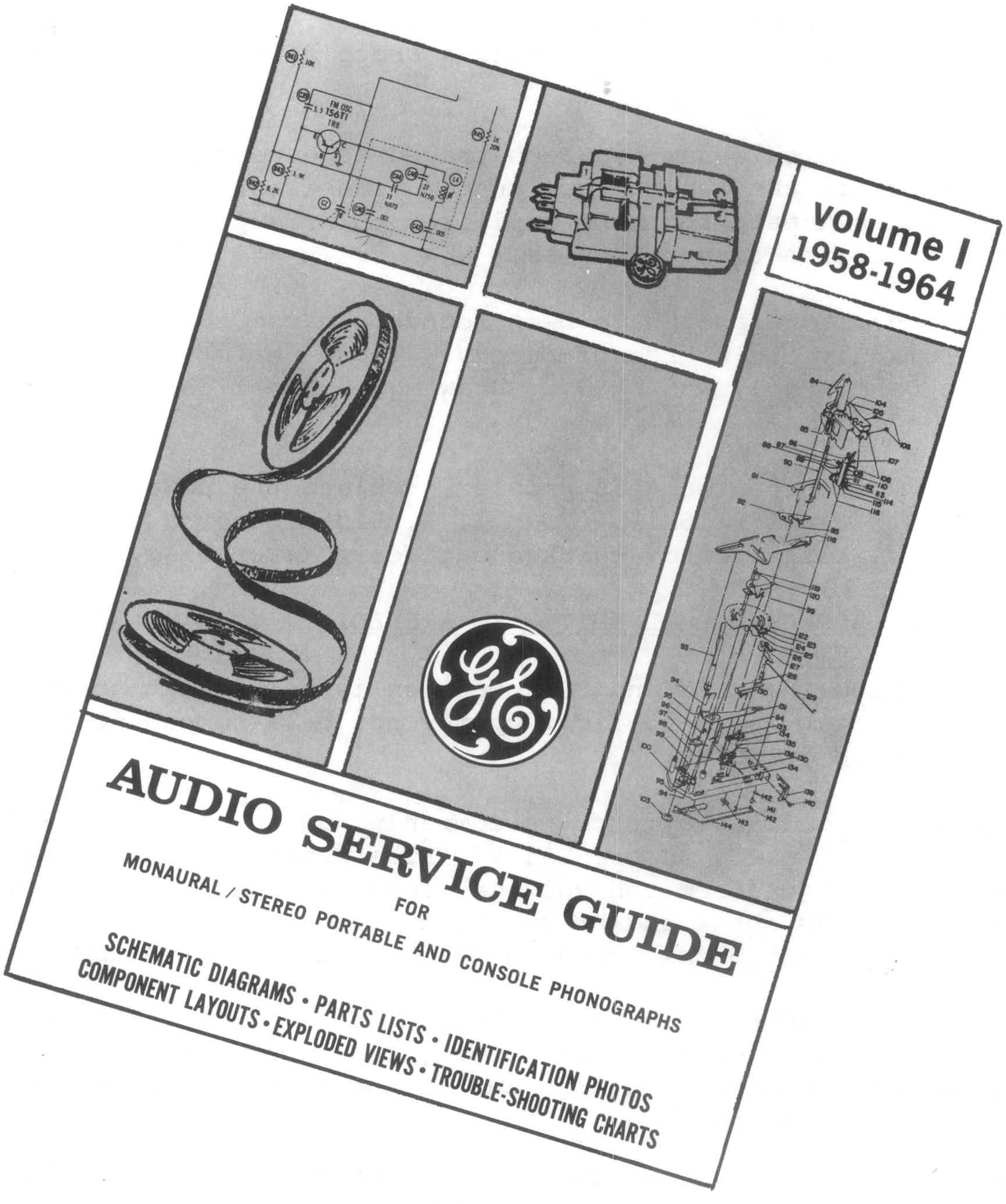
A regulated tuner DC supply voltage according to the specified minus 12 volt ± 5% is very important for proper tuner performance. Checking this voltage, therefore, should be one of the first tests performed when servicing the tuner.

P.S. We erred in marking the issue number of May, 1965 Audio Notes. It should read Volume 4 No. 5 (not No.4). Sorry!

ITS COMING SOON......

WATCH FOR IT!!!

AUDIO SERVICE GUIDE



volume I
1958-1964

AUDIO SERVICE GUIDE

FOR

MONAURAL / STEREO PORTABLE AND CONSOLE PHONOGRAPHS

SCHEMATIC DIAGRAMS • PARTS LISTS • IDENTIFICATION PHOTOS
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Audio Notes

AUDIO PRODUCTS DEPARTMENT — DECATUR, ILL.

VOLUME 4 NO. 9 SEPT-OCT 1965

This month's Audio Notes lists the Console Phonograph Record Changer information in chart form.

CONSOLE PHONO MODEL NO.	RECORD CHANGER IDENT.NO.	CATALOG NUMBER		45 RPM SPINDLE	50 CYCLE KIT NO.
		CARTRIDGE REPLACEMENT	STYLI REPLACEMENT		
RC1240 RC1250	CH17 (VM)	EA97X4 Sonotone-N-8TASD	EA97X5	EA97X174	1
RC1241,42 RC1251,52	CH18 (VM)	EA97X4 Sonotone-N-8TASD	EA97X5	EA97X14	1
RC1200	CH33 (VM)	EA97X8 Astatic 13ATX		EA97X14	1
RC1210	CH36 (VM)	EA97X8 Astatic 13ATX		EA97X174	1
RC1245 RC1255	CH35 (VM)	EA97X4 Sonotone-N-8TASD	EA97X5	EA97X174	1
RC1340 RC1350 RC1430	CH37 (VM)	EA97X4 Sonotone-N-8TASD	EA97X5	EA97X174	1
RC1190	CH40 (VM)	EA97X155 Astatic - 17D	EA97X156	EA97X174	1
RC1195	CH41 (VM)	EA97X155 Astatic - 17D	EA97X156	EA97X174	1
RC1190G & H RC1195G & H	CH44 (VM)	EA97X155 Astatic - 17D	EA97X156	EA97X174	3
RC1611 RC1616	CH43 (VM)	EA97X155 Astatic - 17D	EA97X156	EA97X174	1
RC1611 RC1616	CH43 (VM)	EA97X250 G.E. C-100	EA97X249	EA97X174	1
RC1690	CH42 (VM)	EA97X155 Astatic - 17D EA97X250 G.E. C-100	EA97X156 EA97X249	EA97X174 EA97X174	1 1
RC1710		EA97X155 Astatic - 17D EA97X250 G.E. C-100	EA97X156 EA97X249	EA97X174 EA97X174	1 1
RC1830	CH70 (VM)	EA97X250 G.E. C-100	EA97X249	EA97X174	8
RC3100A RC3110A RC3130A RC3150	CH44 (VM)	EA97X155 Astatic - 17D EA97X250 G.E. C-100	EA97X156 EA97X249	EA97X174 EA97X174	3 3
RC3110AS RC3130AS	Garrard Auto Slim CH47	EA97X250 G.E. C-100	TA-1 EA97X248	EA97X396	9
RC3100C, D RC3110C, D RC3130C, D	CH73 (VM)	EA97X250 G.E. C-100	EA97X249	EA97X174	
RC3190A RC3120C	CH77 (VM)	EA97X250 G.E. C-100	EA97X249	EA97X174	8
RC3200 RC3210 RC3230	CH46 Glaser Steer	EA97X250 G.E. C-100	EA97X249	EA97X174	6
RC1642 RC1652	Garrard CH74	EA97X250 G.E. C-100	TA-1 EA97X248	EA97X467	9
RC1662,63,64 RC1672,73,74	Garrard CH74	EA97X250 G.E. C-100	TA-1 EA97X248	EA97X467	9
RC1661 RC1671	Garrard CH75	EA97X250 G.E. C-100	TA-1 EA97X248	EA97X467	9
RC1970 RC1990	CH71 (VM)	EA97X250	EA97X249	EA97X174	8
RC3200C RC3210C RC3230C	CH77 (VM)	EA97X250 G.E. C-100	EA97X249	EA97X174	8
RC3331A	CH70 (VM)	G.E. C-100 EA97X250	EA97X249	EA97X174	8
RC3332A	CH72 (VM)	EA97X250 G.E. C-100	EA97X249	EA97X174	8
RC3430	CH71 (VM)	EA97X497 G.E. C-200	EA97X249	EA97X174	8
RC3530	CH71 (VM)	EA97X497 G.E. C-200	EA97X249	EA97X174	8
RC4100	CH77 (VM)	EA97X250 G.E. C-100	EA97X249	EA97X174	8

CONSOLE PHONO MODEL NO.	RECORD CHANGER IDENT. NO.	CATALOG NUMBERS		45 RPM SPINDLE	50 CYCLE KIT NO.
		CARTRIDGE REPLACEMENT	STYLI REPLACEMENT		
RC4232A,RC4235A	CH84 (VM)	EA97X250, C200	TA-2, EA97X561	EA97X562	8
RC4231A,RC4331A	CH83 (VM)	EA97X570, C200	TA-2, EA97X561	EA97X562	8
RC4335A,RC4339A	CH84 (VM)	EA97X250, C200	TA-2, EA97X561	EA97X562	8
RC4531, RC4534, RC4535	CH84 (VM)	EA97X570, C200	TA-2, EA97X561	EA97X562	8
RC4621A,RC4631A	CH75, Garrard	EA97X250, C100	TA-1, EA97X248	EA97X467	9
RC4622A,RC4632A	CH74, Garrard	EA97X250, C100	TA-1, EA97X248	EA97X467	9
RC4641A,RC4651A	CH78, Garrard	EA97X569, C100A	TA-2, EA97X561	EA97X467	9
RC4642A,RC4652A	CH79, Garrard	EA97X569, C100A	TA-2, EA97X561	EA97X467	9
RC4821, RC4822, RC4831, RC4832	CH83 (VM)	EA97X569 C100A	EA97X572	# Access.	8
RC4841A, RC4851B RC4851A	CH75, Garrard	EA97X250, C100	TA-1, EA97X248	EA97X467	9
RC4842A, RC4852B RC4852A	CH74, Garrard	EA97X250, C100	TA-1, EA97X248	EA97X467	9
RC4891A	CH80 (VM)	EA97X570, C200	TA-2, EA97X561	EA97X562	8
RC4892A	CH81 (VM)	EA97X570, C200	TA-2, EA97X561	EA97X562	8
5010	CH83, (VM)	EA97X570, C200	TA-2, EA97X561	EA97X562	8
RC6731A,	RD125-3	EA80X165, C500	S/D EA80X166	(EP)EA80X128	11
RC6731AB	RD125-3P	EA80X209, C50/600	S/D EA80X166	EA80X128	11
RC7100A	RD100-14 RD103A-1	EA97X569, C100	TA-2, EA97X561	EA80X128	11
RC7130A	RD100-14 RD103A-1	EA97X569, C100	TA-2, EA97X561	EA80X128	11
RC7230A	RD100B-3	EA80X152, C400	TA-2, EA97X216	EA80X128	11
RC7330A	RD100-5	EA97X570, C200-11	TA-2, EA97X216	EA80X128	11
RC7430A,	RD110-3,	EA80X152, C400-5	TA-2, EA97X216	EA80X128	11
RC7430AB	RD110-3P	EA80X208, C40	TA-2, EA97X216	EA80X128	11
RC7440	RD125-4	EA80X165, C500	EA80X166	EA80X128	11
RC7441AB	RD125-4AP	EA80X209, C50	EA80X166	EA80X210	11
RC7530A	RD125-4	EA80X165, C500	EA80X166	EA80X128	11
RC7530AB	RD125-4AP	EA80X209, C50/600	EA80X166	EA80X128	11
RC7630A	RD125-3	EA80X165, C500	EA80X166	EA80X128	11
RC7630AB	RD125-3AP	EA80X209,C50/C600	EA80X166	EA80X128	11
RC7690A	RD125-4AP	EA80X209,C50/600	EA80X166	EA80X128	11
RC7730A	RD125-3	EA80X165,C500	EA80X166	EA80X128	11
RC7730AB	RD125-3P	EA80X209, C50/600	EA80X166	EA80X128	11
RC7741A	RD125-5	EA80X165,C500	EA80X166	EA80X128	11
RC7741AB	RD125-5AP	EA80X165, C50	EA80X166	EA80X128	11
RC7830A	RD125-3	EA80X165(EP) C500	EA80X166	EA80X128 (EP)	11
RC7830AB	RD125-3P	EA80X209(LP)C50/600	EA80X166	EA80X210 (LP)	11
RC7890A	RD125-4	EA80X165(EP) C500	EA80X166	EA80X128 (EP)	11
RC7890AB	RD125-4P	EA80X209(LP)C50/C600	EA80X166	EA80X210 (LP)	11
RC8170A	RD110-3	EA80X152, C400	EA97X561	EA80X128 (EP)	11
RC8170AB	RD110-3P	EA80X208,C40/C450	EA97X561	EA80X210 (LP)	11
RC8370A	RD125-3	EA80X165,C500	EA80X166	EA80X128 (EP)	11
RC8370AB	RD125-3P	EA80X209,C50/C600	EA80X166	EA80X210 (LP)	11
RC8570A	RD125-3	EA80X165,C500	EA80X166	EA80X128 (EP)	11
RC8570AB	RD125-3P	EA80X209	EA80X166	EA80X128 (LP)	11
MC9430A	RD125-4	EA80X165, C500	EA80X166	EA80X128 (EP)	11
MC9430AB	RD125-4AP	EA80X209, C50	EA80X166	EA80X210 (LP)	11
MC9630	RD125-3	EA80X165,C500	EA80X166	EA80X128 (EP) EA80X210 (LP)	11
CC9731A	RD125-4	EA80X165, C500	EA80X166	EA80X128 (EP)	11
CC9939A	RD125-3	EA80X165, C500	EA80X166	EA80X210 (LP)	11
CC9931A	RD125-3	EA80X165, C500	EA80X166	EA80X128 (EP) EA80X210 (LP)	11

NOTE: (EP) - Early Production (Round Adaptor)
(LP) - Late Production (Flat Adaptor)

Audio Notes

AUDIO PRODUCTS DEPARTMENT – DECATUR, ILL.

VOLUME 5 NO. 1 JAN-FEB 1966

This month Audio Notes consists of an up dated list containing Console Phonograph Record Changer and Tape Deck information in chart form.

CONSOLE PHONO MODEL NO.	RECORD CHANGER IDENT. NO.	CATALOG NUMBER		45 RPM SPINDLE	50 CYCLE KIT NO.
		CARTRIDGE REPLACEMENT	STYLI REPLACEMENT		
RC1240 RC1250	CH17 (VM)	EA97X4 Sonotone-N-8TASD	EA97X5	EA97X174	1
RC1241,42 RC1251,52	CH18 (VM)	EA97X4 Sonotone-N-8TASD	EA97X5	EA97X14	1
RC1200	CH33 (VM)	EA97X8 Astatic 13ATX		EA97X14	1
RC1210	CH36 (VM)	EA97X8 Astatic 13ATX		EA97X174	1
RC1245 RC1255	CH35 (VM)	EA97X4 Sonotone-N-8TASD	EA97X5	EA97X174	1
RC1340 RC1350 RC1430	CH37 (VM)	EA97X4 Sonotone-N-8TASD	EA97X5	EA97X174	1
RC1190	CH40 (VM)	EA97X155 Astatic - 17D	EA97X156	EA97X174	1
RC1195	CH41 (VM)	EA97X155 Astatic - 17D	EA97X156	EA97X174	1
RC1190G & H RC1195G & H	CH44 (VM)	EA97X155 Astatic - 17D	EA97X156	EA97X174	3
RC1611 RC1616	CH43 (VM)	EA97X155 Astatic - 17D	EA97X156	EA97X174	1
RC1611 RC1616	CH43 (VM)	EA97X250 G.E. C-100	EA97X249	EA97X174	1
RC1690	CH42 (VM)	EA97X155 Astatic - 17D	EA97X156	EA97X174	1
		EA97X250 G.E. C-100	EA97X249	EA97X174	1
RC1710		EA97X155 Astatic - 17D	EA97X156	EA97X174	1
		EA97X250 G.E. C-100	EA97X249	EA97X174	1
RC1830	CH70 (VM)	EA97X250 G.E. C-100	EA97X249	EA97X174	8
RC3100A RC3110A	CH44 (VM)	EA97X155 Astatic - 17D	EA97X156	EA97X174	3
RC3130A RC3150		EA97X250 G.E. C-100	EA97X249	EA97X174	3
RC3110AS RC3130AS	Garrard Auto Slim CH47	EA97X250 G.E. C-100	TA-1 EA97X248	EA97X396	9
RC3100C, D RC3110C, D RC3130C, D	CH73 (VM)	EA97X250 G.E. C-100	EA97X249	EA97X174	8
RC3190A RC3120C	CH77 (VM)	EA97X250 G.E. C-100	EA97X249	EA97X174	8
RC3200 RC3210 RC3230	CH46 Glaser Steer	EA97X250 G.E. C-100	EA97X249	EA97X174	6
RC1642 RC1652	Garrard CH74	EA97X250 G.E. C-100	TA-1 EA97X248	EA97X467	9
RC1662,63,64 RC1672,73,74	Garrard CH74	EA97X250 G.E. C-100	TA-1 EA97X248	EA97X467	9
RC1661 RC1671	Garrard CH75	EA97X250 G.E. C-100	TA-1 EA97X248	EA97X467	9
RC1970 RC1990	CH71 (VM)	EA97X250	EA97X249	EA97X174	8
RC3200C RC3210C RC3230C	CH77 (VM)	EA97X250 G.E. C-100	EA97X249	EA97X174	8
RC3331A	CH70 (VM)	G.E. C-100 EA97X250	EA97X249	EA97X174	8
RC3332A	CH72 (VM)	EA97X250 G.E. C-100	EA97X249	EA97X174	8
RC3430	CH71 (VM)	EA97X497 G.E. C-200	EA97X249	EA97X174	8
RC3530	CH71 (VM)	EA97X497 G.E. C-200	EA97X249	EA97X174	8
RC4100	CH77 (VM)	EA97X250 G.E. C-100	EA97X249	EA97X174	8

CONSOLE PHONO MODEL NO.	RECORD CHANGER/TAPE DECK IDENT. NUMBER	CATALOG NUMBER		45 RPM SPINDLE	50 CYCLE KIT NO.
		CARTRIDGE REPLACEMENT	STYLUS REPLACEMENT		
RC4232A RC4235A	CH84 (VM)	EA97X250 G.E. C-200	TA-2 EA97X561	EA97X562	8
RC4231A RC4331A	CH83 (VM)	EA97X570 G.E. C-200	TA-2 EA97X561	EA97X562	8
RC4335A RC4339A	CH84 (VM)	EA97X250 G.E. C-200	TA-2 EA97X561	EA97X562	8
RC4341A	CH83	C200 EA97X570	TA-2 EA97X561	EA97X562	8
RC4341A	TD100				12
RC4341B	CH83	C200 EA97X570	TA-2 EA97X561	EA97X562	8
RC4341B	TD150				12
RC4531 RC4534 RC4535	CH84 (VM)	EA97X570 C-200	TA-2 EA97X561	EA97X562	8
RC4621A RC4631A	CH75 Garrard	EA97X250 G.E. C-100	TA-1 EA97X248	EA97X467	9
RC4622A RC4632A	CH74 Garrard	EA97X250 G.E. C-100	TA-1 EA97X248	EA97X467	9
RC4641A RC4651A	CH78 Garrard	EA97X569 C-100A	TA-2 EA97X561	EA97X467	9
RC4642A RC4652A	CH79 Garrard	EA97X569 C-100A	TA-2 EA97X561	EA97X467	9
RC4671A	CH86 Garrard	EA97X570 G.E. C-200	TA-2 EA97X561	EA97X467	9
RC4672A RC4673A RC4674A	CH85 Garrard	EA97X570 G.E. C-200	TA-2 EA97X561	EA97X467	9
RC4821 RC4822 RC4831 RC4832	CH83 (VM)	EA97X569 C-100A	EA97X572	#Access.	8
RC4841A RC4851B RC4851A	CH75 Garrard	EA97X250 G.E. C-100	TA-1 EA97X248	EA97X467	9
RC4842A RC4852B RC4852A	CH74 Garrard	EA97X250 G.E. C-100	TA-1 EA97X248	EA97X467	9
RC4891A	CH80 (VM)	EA97X570 G.E. C-200	TA-2 EA97X561	EA97X562	8
RC4892A	CH81 (VM)	EA97X570 G.E. C-200	TA-2 EA97X561	EA97X562	8
5010	CH83	C200 EA97X570	TA-2 EA97X561	EA97X562	8
5040A	TD100				12
5040B	TD150				12
RC6731A RC6731AB	RD125-3 RD125-3P	C-500 EA80X165 C50/600 EA80X209	S/D EA80X166 S/D EA80X166	(EP) EA80X128 EA80X128	11 11
RC7100A RC7130A	RD100-14 RD103A-1 RD100-14 RD103A-1	C-100 EA97X569 C-100 EA97X569	TA-2 EA97X561 G.E. TA-2 EA97X561	EA80X128 EA80X128	11 11
RC7230A	RD100B-3	EA80X152 C-400	G.E. TA-2 EA97X216	EA80X128	11
RC7330A	RD100-5	EA97X570 C-200-11	G.E. TA-2 EA97X216	EA80X128	11
RC7430A RC7430AB	RD110-3 RD110-3P	EA80X152 C-400-5 EA80X208 C40	G.E. TA-2 EA97X216 G.E. TA-2 EA97X216	EA80X128 EA80X128	11 11
RC7441A	RD125-4	EA80X165 C-500	EA80X166	EA80X128	11
RC7441A	TD150				12
RC7441AB	RD125-4AP	EA80X209 C50	EA80X166	EA80X210	11
RC7441AB	TD150				12

CONSOLE PHONO MODEL NO.	RECORD CHANGER/TAPE DECK IDENT. NUMBER	CATALOG NUMBER			
		CARTRIDGE REPLACEMENT	STYLUS REPLACEMENT	45 RPM SPINDLE	50 CYCLE KIT NO.
TC5741BWD	RD225-5	C650 EA80X234	C650 EA80X235	EA80X210	11
TC5741BWD	TD155				12
TC5749BCL	RD225-5	C650 EA80X234	C650 EA80X235	EA80X210	11
TC5749BCL	TD155				12
RC6531BWD	RD210-3	C650 EA80X234	C650 EA80X235	EA80X210	11
RC6731BWD	RD225-6	C650 EA80X234	C650 EA80X235	EA80X210	11
RC6732BMP	RD225-6	C650 EA80X234	C650 EA80X235	EA80X210	11
RC6791BWD	RD210-5	C650 EA80X234	C650 EA80X235	EA80X210	11
RC7000BMD	RD100B-5	Astatic 142 EA80X214	Astatic N72 EA80X215	EA80X210	11
RC7001BWD	RD100B-5	Astatic 142 EA80X214	Astatic N72 EA80X215	EA80X210	11
RC7010BMD	RD210-8	Astatic 142 EA80X214	Astatic N72 EA80X215	EA80X210	11
RC7011BWD	RD210-8	Astatic 142 EA80X214	Astatic N72 EA80X215	EA80X210	11
RC7200BMD	RD210-6	C650 EA80X234	C650 EA80X235	EA80X210	11
RC7201BWD	RD210-6	C650 EA80X234	C650 EA80X235	EA80X210	11
RC7202BMP	RD210-6	C650 EA80X234	C650 EA80X235	EA80X210	11
RC7210BMD	RD210-3	C650 EA80X234	C650 EA80X235	EA80X210	11
RC7211BWD	RD210-3	C650 EA80X234	C650 EA80X235	EA80X210	11
RC7212BMP	RD210-3	C650 EA80X234	C650 EA80X235	EA80X210	11
RC7230BMD	RD210-3	C650 EA80X234	C650 EA80X235	EA80X210	11
RC7231BWD	RD210-3	C650 EA80X234	C650 EA80X235	EA80X210	11
RC7232BMP	RD210-3	C650 EA80X234	C650 EA80X235	EA80X210	11
RC7431BWD	RD210-5	C650 EA80X234	C650 EA80X235	EA80X210	11
RC7432BMP	RD210-5	C650 EA80X234	C650 EA80X235	EA80X210	11
RC7436BPN	RD210-5	C650 EA80X234	C650 EA80X235	EA80X210	11
RC7490BML	RD210-3	C650 EA80X234	C650 EA80X235	EA80X210	11
RC7491BWD	RD210-3	C650 EA80X234	C650 EA80X235	EA80X210	11
RC7492BMP	RD210-3	C650 EA80X234	C650 EA80X235	EA80X210	11
RC7531BWD	RD225-3	C650 EA80X234	C650 EA80X235	EA80X210	11
RC7532BMP	RD225-3	C650 EA80X234	C650 EA80X235	EA80X210	11
RC7539BCL	RD225-3	C650 EA80X234	C650 EA80X235	EA80X210	11
RC7554BCL	RD225-3	C650 EA80X234	C650 EA80X235	EA80X210	11
RC7591BWD	RD225-3	C650 EA80X234	C650 EA80X235	EA80X210	11
RC7592BMP	RD225-3	C650 EA80X234	C650 EA80X235	EA80X210	11
RC7596BPN	RD225-3	C650 EA80X234	C650 EA80X235	EA80X210	11

CONSOLE PHONO MODEL NO.	RECORD CHANGER/TAPE DECK IDENT. NUMBER	CATALOG NUMBER		45 RPM SPINDLE	50 CYCLE KIT NO.
		CARTRIDGE REPLACEMENT	STYLUS REPLACEMENT		
RC7530A	RD125-4	EA80X165	EA80X166	EA80X128	11
		C500			
RC7530AB	RD125-4AP	EA80X209	EA80X166	EA80X128	11
		C50/C600			
RC7630A	RD125-3	EA80X165	EA80X166	EA80X128	11
		C500			
RC7630AB	RD125-3AP	EA80X209	EA80X166	EA80X128	11
		C50/C600			
		C50/C600			
RC7690A	RD125-4AP	EA80X209	EA80X166	EA80X128	11
		C500			
RC7730A	RD125-3	EA80X165	EA80X166	EA80X128	11
RC7730AB	RD125-3P	EA80X209	EA80X166	EA80X128	11
		C50/C600			
RC7741A	RD125-5	C500			
		EA80X165	EA80X166	EA80X128	11
RC7741A	TD150				12
RC7741AB	RD125-5AP	C50			
			EA80X166	EA80X128	11
RC7741AB	TD150				12
RC7830A	RD125-3	C500	EA80X166	EA80X128 (EP)	11
		EA80X165 (EP)			
RC7830AB	RD125-3P	C50/C600			
		EA80X209 (LP)	EA80X166	EA80X210 (LP)	11
RC7890A	RD125-4	C500	EA80X166	EA80X128 (EP)	11
		EA80X165 (EP)			
RC7890AB	RD125-4P	C50/C600	EA80X166	EA80X210 (LP)	11
		EA80X209 (LP)			
RC8170A	RD110-3	C400	EA97X561	EA80X128 (EP)	11
		EA80X152			
RC8170AB	RD110-3P	C40/C450	EA97X561	EA80X210 (LP)	11
		EA80X208			
RC8370A	RD125-3	C500	EA80X166	EA80X128 (EP)	11
		EA80X165			
RC8370AB	RD125-3P	C50/C600	EA80X166	EA80X210 (LP)	11
		EA80X209			
		C500			
RC8570A	RD125-3	EA80X165	EA80X166	EA80X128 (EP)	11
		C50/C600			
RC8570AB	RD125-3P	EA80X209	EA80X166	EA80X210 (LP)	11
		C500			
MC9430A	RD125-A	EA80X165	EA80X166	EA80X128 (EP)	11
		C50			
MC9430AB	RD125-4AP	EA80X209	EA80X166	EA80X210 (LP)	11
		C500		EA80X128 (EP)	
MC9630	RD125-3	EA80X165	EA80X166	EA80X210 (LP)	11
CC9731A	RD125-4	C500			
		EA80X165	EA80X166	EA80X128 (EP)	11
CC9939A	RD125-3	C500			
		EA80X165	EA80X166	EA80X210 (LP)	11
		C500		EA80X128 (EP)	
CC9931A	RD125-3	EA80X165	EA80X166	EA80X210 (LP)	11
TC5261A	TD155				12
RC5442A	RD125-4AP	C50/C600	EA80X166	EA80X210	11
		EA80X209			
RC5442A	TD150				12
		C650	C650		
TC5441CWD	RD225-3	EA80X234	EA80X235	EA80X210	11
TC5441CWD	TD155				12
		C650	C650		
TC5442BMP	RD225-3	EA80X234	EA80X235	EA80X210	11
TC5442BMP	TD155				12

NOTE: (EP) - Early Production - Round Adaptor
(LP) - Late Production - Flat Adaptor

CONSOLE PHONO MODEL NO.	RECORD CHANGER/TAPE DECK IDENT. NUMBER	CATALOG NUMBER		45 RPM SPINDLE	50 CYCLE KIT NO.
		CARTRIDGE REPLACEMENT	STYLUS REPLACEMENT		
RC7631BWD	RD225-3	C650 EA80X234	C650 EA80X235	EA80X210	11
RC7632BMP	RD225-3	C650 EA80X234	C650 EA80X235	EA80X210	11
RC7651BWD	RD225-3	C650 EA80X234	C650 EA80X235	EA80X210	11
PFRC7681BWD	RD225-3	C650 EA80X234	C650 EA80X235	EA80X210	11
PFRC7682BMP	RD225-3	C650 EA80X234	C650 EA80X235	EA80X210	11
RC7691BWD	RD225-3	C650 EA80X234	C650 EA80X235	EA80X210	11
RC7692BMP	RD225-3	C650 EA80X234	C650 EA80X235	EA80X210	11
RC7696BPN	RD225-3	C650 EA80X234	C650 EA80X235	EA80X210	11
RC7699BCL	RD225-3	C650 EA80X234	C650 EA80X235	EA80X210	11
RC7731BWD	RD225-3	C650 EA80X234	C650 EA80X235	EA80X210	11
RC7735BWL	RD225-3	C650 EA80X234	C650 EA80X235	EA80X210	11
RC7831BWD	RD225-4	C650 EA80X234	C650 EA80X235	EA80X210	11
RC7836BPN	RD225-4	C650 EA80X234	C650 EA80X235	EA80X210	11
RC7839BCL	RD225-4	C650 EA80X234	C650 EA80X235	EA80X210	11
MC9631BWD	RD210-5	C650 EA80X234	C650 EA80X235	EA80X210	11
MC9632BMP	RD210-5	C650 EA80X234	C650 EA80X235	EA80X210	11
CC9131BWD	RD225-6	C650 EA80X234	C650 EA80X235	EA80X210	11
CC9132BMP	RD225-6	C650 EA80X234	C650 EA80X235	EA80X210	11
CC9531BWD	RD225-6	C650 EA80X234	C650 EA80X235	EA80X210	11

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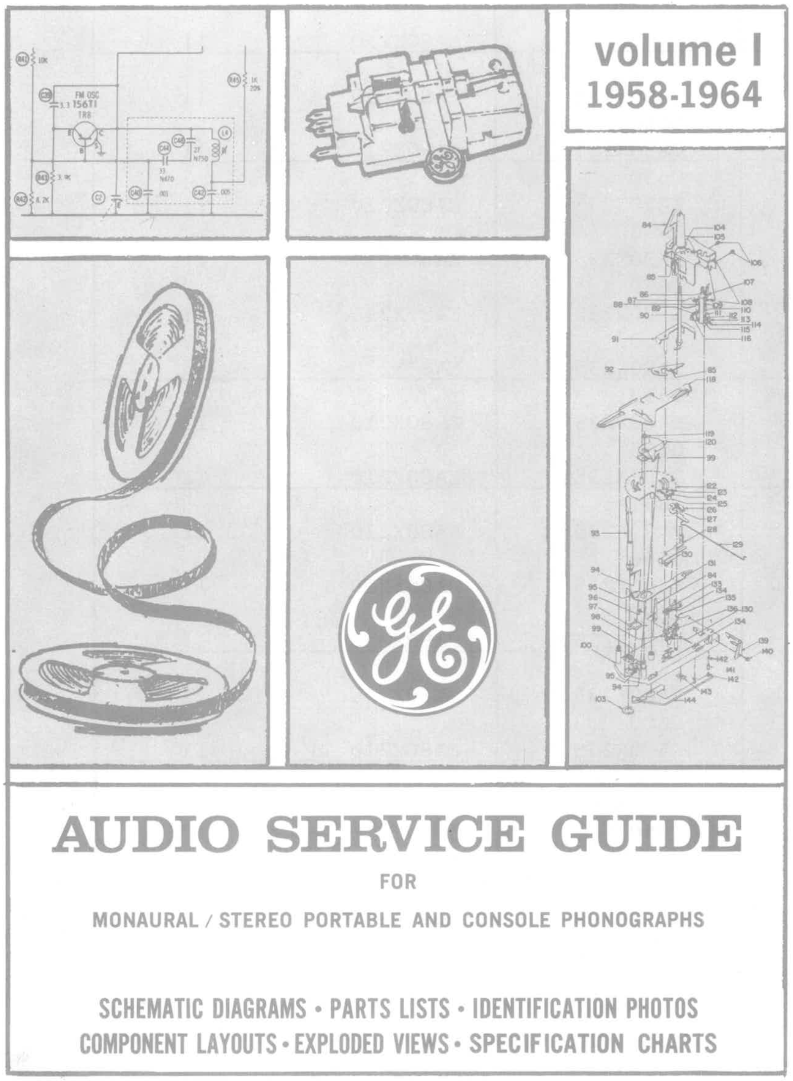
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